DOCUMENT RESUME

ED 163 102 UD 018 765

TITLE	Opportunities for Minority Students in Biomedical Research.
INSTITUTION	National Heart and Lung Inst. (DHEW/PHS), Bethesda, Md.
REPORT NO	DHEW-NIH-78-1213
PUB DATE	78
NOTE	24p.
EDRS PRICE	MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS	*Career Opportunities; *Employment Opportunities; Higher Education; Minority Groups; *Science Careers
IDENTIFIERS	*Biomedical Research

ABSTRACT

Information in this pamphlet provides the science student with ideas about where to look for career opportunities in biomedical research and what further information to seek. The primary research programs of each division of the National Heart, Lung and Blood Institute are outlined and are accompanied by descriptions of important research areas and suggested fields of study. At the end of each description is a grid which cross references certain fields of study to the research programs described in the pamphlet. (Author/WI)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

NOV 9 1978

National Heart, Lung, and Blood Institute's

SCOPE OF INTEREST NOTICE
The ERIC Facility has assigned this document for processing to: CD SE
In our judgement, this document is also of interest to the clearinghouses noted to the right. Indexing should reflect their special points of view.

OPPORTUNITIES FOR MINORITY STUDENTS IN BIOMEDICAL RESEARCH

ED163102

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

UD018765

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service National Institutes of Health

DISCRIMINATION PROHIBITED: Under provisions of applicable public laws enacted by Congress since 1964, no person in the United States shall, on the ground of race, color, national origin, sex, or handicap, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance. In addition, Executive Order 11141 prohibits discrimination on the basis of age by contractors and subcontractors in the performance of Federal contracts. Therefore, the National Heart, Lung, and Blood Institute must be operated in compliance with these laws and executive order.

PREFACE

Minority students in the sciences should consider a future in biomedical research. If a college or graduate student is interested in the biomedical field, what academic programs might he or she pursue in graduate school? What specific topics might be part of the study requirements for a graduate degree?

Opportunities for well-prepared, serious researchers are often available through the National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health. The mission of NHLBI is to provide leadership for a national research program in diseases of the heart, blood vessels, blood, and lungs — diseases that affect more than 30 million Americans at an annual cost of more than $40 billion. The NHLBI plans, conducts, fosters, and supports an integrated program of research, investigations, clinical trials, and demonstrations related to the causes, prevention, diagnosis, and treatment of heart, blood vessel, blood, and lung diseases through research performed in its own facilities and through the sponsorship of grants and contracts to scientific institutions and individuals. There is hope for prevention and cure of these diseases through scientific research, application of knowledge, and health education.

This pamphlet describes areas of biomedical research sponsored by the three Divisions (Heart and Vascular Diseases, Lung Diseases, and Blood Diseases and Resources) of the NHLBI and provides examples of academic disciplines that help prepare a scientist for research in those areas. For further information, contact:

Mrs. Juanita Cooke
Coordinator for Minority Affairs
National Heart, Lung, and Blood Institute
Building 31, Room 5A19
Bethesda, Maryland 20014

ABOUT THIS PAMPHLET. . .

Information in this pamphlet provides a basic index that will give the science student ideas about where to look for career opportunities in biomedical research and what further information to seek. If you are a graduate student, you already have some knowledge about the various research programs described, but, if you are an undergraduate, you are not expected to be knowledgeable about the research areas yet. As an undergraduate student in a science curriculum, you are busy with the foundation courses in science and may be preparing for a career or for further study after graduation. If you intend to go to graduate school, you will soon encounter some of the concepts presented in this pamphlet. If any of the research areas are of interest, you may want to start now by reading about that area and consulting a science advisor about graduate schools that offer the best programs in that subject.

The primary research programs of each Division of the National Heart, Lung, and Blood Institute are described briefly and are accompanied by a list of important research areas plus a list of suggested fields of study. At the end of each description, a grid is included that cross-references certain fields of study to the research programs discussed in the pamphlet.

Although an interdisciplinary approach to research is often appropriate for studies leading to a graduate degree, a student should probably select one field as a major subject. Certain fields of study, however, are fundamental to almost all biomedical research — especially biophysics, biochemistry, physiology, biostatistics, and techniques in the automated analysis of data.

If you have already narrowed your interests to a particular area of research, such as arteriosclerosis in animal models, then you may want to make inquiries about specific opportunities in biomedical research.

DIVISION OF HEART AND VASCULAR DISEASES

The Division of Heart and Vascular Diseases conducts and sponsors research into the epidemiology, causes, and basic biological mechanisms and processes of heart and blood vessel diseases, as well as programs for prevention and control of these diseases. Although most of the research supported is fundamental and investigator-initiated, research is being emphasized in areas such as sudden cardiac death, hypertension, heart muscle damage after acute heart attacks, noninvasive diagnostic techniques of heart and vascular diseases, and animal models of these diseases.

RESEARCH PROGRAMS

1. Arteriosclerosis

Arteriosclerosis, or "hardening of the arteries," is the most common serious disease in Western society. It is a chronic, progressive, pathologic change in which the inner lining of the arteries becomes rough, thick, hard, and covered with lipid-rich plaques. Eventually, the inner diameter of the vessels decreases and blood flow diminishes or stops completely.

Fields of Study
Behavioral Sciences
Biochemistry
Bioengineering
Biostatistics
Cell Biology
Electrophysiology
Epidemiology
Genetics
Nutrition
Pathogenetics
Pathology
Pharmacology
Physical Chemistry
Physiology
Radiography
Rehabilitation

Areas of Research
Etiology and pathogenesis of arteriosclerosis
Diagnosis: Invasive and noninvasive techniques to determine arteriosclerotic changes in blood vessels, hyperlipoproteinemia, and other risk factors
Animal models: Arteriosclerosis, high blood pressure, cerebral vascular disease, genetic defects
Hyperlipoproteinemia in young people
Environmental risk factors
Life-style and personality attributes in relation to disease and therapy
Cholesterol and lipid metabolism
Diabetes and cardiovascular disease
Blood coagulation

2. Hypertension

About 23 million adult Americans have hypertension (high blood pressure), a disorder that is more common in the black population than in the white population. It predisposes one to arteriosclerosis and stroke, and is a risk factor for heart attack and heart failure. In more than nine out of ten cases of hypertension, the cause is unknown, and the disorder cannot yet be prevented or cured; however, treatment and control are possible.

Fields of Study
Behavioral Sciences
Biochemistry
Biostatistics
Epidemiology
Genetics
Health Education
Morphology
Pathology
Pharmacology
Physiology

Areas of Research
Causes and progression of high blood pressure
Therapy
Blood pressure in children: Epidemiology, early prevention of high blood pressure
High blood pressure education

3. Cerebrovascular Disease

Cerebrovascular disease occurs when an artery supplying blood to the brain is blocked, ruptured, or injured. It is due primarily to arteriosclerosis and hypertension, and may result in death, paralysis, or brain damage.

Fields of Study
Anatomy
Behavioral Sciences
Biochemistry
Bioengineering
Biostatistics
Epidemiology
Genetics
Hematology
Pathology
Physiology
Radiology

Areas of Research
Etiology and pathogenesis
Animal models: Atherosclerosis in the cerebrovascular arteries
Diagnosis by invasive and noninvasive techniques
Environmental and life-style factors

4. Coronary Heart Disease

A heart attack is a manifestation of coronary heart disease and occurs when a coronary artery is blocked by atherosclerosis, preventing blood from reaching the heart muscle. This causes death of the heart muscle (myocardial infarction). A small or a large fraction of the total heart may be involved, depending upon the site of the coronary blockage.

Fields of Study
Behavioral Sciences
Biochemistry
Endocrinology
Genetics
Nutrition
Morphology
Pharmacology
Public Health Administration
Rehabilitation

Areas of Research
Heart attacks: Precipitating mechanisms and factors
Therapy: Drugs, surgery, emergency medical care systems, cardiac rehabilitation
Personality factors as risk factors

5. Peripheral Vascular Diseases

Peripheral vascular diseases are caused by abnormalities that occur within arteries or veins. Atherosclerotic narrowing may result in inadequate blood flow through the arteries. The veins may become dilated (varicosities) or inflamed or obstructed by blood clots (thrombophlebitis). These diseases may result in organ damage, skin ulcerations, and gangrene.

Fields of Study
Bioengineering
Epidemiology
Genetics
Hematology
Pharmacology
Physiology
Radiography
Rehabilitation

Areas of Research
Causes: Neural control of vascular tone, mechanisms of smooth muscle action, peripheral atherosclerosis
Diagnosis: Instrumentation
Therapy: Drugs, surgery
Rehabilitation

6. Arrhythmias

Arrhythmias, or abnormal heart rhythms, are frequently the immediate cause of heart failure and death. Arrhythmias result from an alteration in the normal generation and transmission of electrical impulses within the heart.

Fields of Study	Areas of Research
Biochemistry Bioengineering Electrophysiology Pharmacology Physiology Rehabilitation	Rhythm disturbances associated with inadequate blood supply to heart muscle Therapy: Antiarrhythmic drugs

7. Heart Failure and Shock

Heart failure and shock are major causes of death and may be the consequences of various disorders, ranging from inadequate pumping by a severely damaged heart (cardiogenic shock), loss of blood (hemorrhagic shock), to impairment in the control of arterial tone.

Fields of Study	Areas of Research
Biochemistry Bioengineering Biostatistics Cell Biology Electrophysiology Physiology	Fundamental processes associated with heart muscle survival Therapies for minimizing heart muscle damage Myocardial metabolism

8. Congenital and Rheumatic Heart Disease

Congenital heart disease occurs when the heart or major blood vessels near the heart fail to mature normally before birth. There are 35 recognizable types of congenital heart defects, and about 25,000 babies are born each year with heart defects. Rheumatic heart disease is an immunological disturbance that frequently occurs years after initial rheumatic fever. It can lead to serious damage to the heart valves.

Fields of Study	Areas of Research
Biochemistry Bioengineering Electrophysiology Epidemiology Genetics Immunology Public Health Administration	Heart disease in children: Congenital heart disease, rheumatic fever and heart disease, precursors of heart disease in adults Early recognition of cardiac problems in the newborn: Instrumentation for detection, diagnostic and surgical facilities, professional education, interhospital communication and transportation

9. Cardiomyopathies and Infections of the Heart

Cardiomyopathies and infections of the heart are diseases of the heart muscle and its lining that cause enlargement of the heart, heart failure, irregularities of the heart rhythm, and occasionally, sudden death. Known factors producing cardiomyopathies include toxic substances, viral infections, alcohol, immunological phenomena, nutritional deficiencies, muscular dystrophy, and a number of rare diseases. Infections may affect the heart muscle (myocarditis), its interior wall (endocarditis), or its exterior surface (pericarditis). They may be caused by certain viruses, bacteria, or fungi.

Fields of Study	Areas of Research
Biochemistry Epidemiology Genetics Immunology Pharmacology Physiology Virology	Causes and epidemiology of cardiomyopathies and infections of the heart Therapy Mechanisms of myocardial damage

10. Circulatory Assistance

Circulatory assistance devices are designed to improve the mechanical function of the heart; the apparatus generally involves electronic, pneumatic, hydraulic, and mechanical systems and biocompatible materials.

Fields of Study	Areas of Research
Behavioral Sciences Biochemistry Bioengineering Electrophysiology Physiology Polymer Chemistry Radiography	Noninvasive and invasive instruments for assessing cardiovascular performance Circulatory assist and artificial heart systems Biocompatible materials

DIVISION OF HEART AND VASCULAR DISEASES	Arteriosclerosis	Hypertension	Cerebrovascular Disease	Coronary Heart Disease	Peripheral Vascular Disease	Arrhythmias	Heart Failure and Shock	Congenital and Rheumatic Heart Diseases	Cardiomyopathies and Infections of the Heart	Circulatory Assistance
Anatomy, Ultrastructural Anatomy	●	●	●	●						
Behavioral Sciences	●	●	●	●	●		●	●	●	●
Biochemistry	●	●	●	●	●	●	●	●	●	●
Bioengineering	●		●	●	●	●	●	●		●
Biostatistics	●	●	●	●	●	●	●	●	●	
Cell Biology	●			●			●			
Chemistry	●									
Electrophysiology	●			●	●	●	●	●	●	●
Endocrinology	●		●	●	●		●			
Epidemiology	●	●	●	●	●	●	●	●	●	
Genetics	●	●	●	●	●	●	●	●	●	
Health Education		●								
Hematology	●		●	●	●		●	●		●
Histology				●						
Immunology								●	●	●
Molecular Biology				●						
Morphology		●		●						
Nutrition	●	●		●	●		●	●	●	
Pathology	●	●	●	●	●	●	●	●	●	●
Pharmacology	●	●	●	●	●	●	●	●	●	●
Physiology	●	●	●	●	●	●	●	●	●	●
Polymer Chemistry										●
Public Health Administration		●		●				●		
Radiography	●		●	●	●	●	●	●	●	●
Rehabilitation	●		●	●	●	●		●	●	●
Virology								●	●	

DIVISION OF LUNG DISEASES

Chronic lung diseases included in the program of the Division of Lung Diseases affect about 10 million Americans, cause about 150,000 deaths per year, and cost the national economy about $6 billion.

Research programs of the Division focus on three specific areas:

- structure and function of the lung to increase our understanding of the disease process;
- specific pulmonary diseases which constitute national health problems, but for which information is insufficient to provide solutions; and
- availability of technical resources to solve specific health problems.

RESEARCH PROGRAMS

1. Structure and Function of the Lung

As a gas exchanger, the lung provides oxygen to the blood and removes excess carbon dioxide. Nonrespiratory functions include metabolism and defense of the system. Fundamental knowledge is needed about the functions and structural components — such as airways, alveoli, collagen, elastin, and cell types — to solve the problems of pulmonary disease.

Fields of Study
Biochemistry
Cell Biology
Histology
Immunology
Molecular Biology
Morphology
Pharmacology
Physiology

Areas of Research
Lung Structure:
Gross morphology — Airways, alveoli
Connective tissue — Collagen, elastin
Cell structure
Lung Function:
Respiratory function — Gas exchange, mechanics
Metabolic function — Intermediary metabolism, phospholipid and protein synthesis; production, release, and metabolism of pharmacologically active compounds
Defense function — Cellular, immunological

2. Pediatric Pulmonary Diseases

The most important disorders of childhood involving the lung and airways are hyaline membrane disease (neonatal respiratory distress syndrome), cystic fibrosis (abnormal mucus secretion), and bronchiolitis.

Fields of Study
Biochemistry
Bioengineering
Cell Biology
Epidemiology
Genetics
Molecular Biology
Pharmacology
Physiology
Radiography
Rehabilitation

Areas of Research
Prenatal and neonatal environment: Biochemical and physiologic features, alterations of mucus
Devices to assess pulmonary function
Therapy: Physiotherapy, bronchodilators, pharmacologic agents

3. Emphysema and Chronic Bronchitis

Emphysema is a disease in which thin walls in the alveoli lose their elasticity and tear. Chronic bronchitis is a persistent inflammation of the lungs, characterized by recurrent coughing and excessive mucus in the airways.

Fields of Study
Biochemistry
Bioengineering
Biostatistics
Epidemiology
Genetics
Morphology
Pathology
Physiology
Radiography
Rehabilitation

Areas of Research
Tissue destruction: Response to injury, repair processes
Etiology and pathogenesis: Host factors, environmental agents
Early detection

4. Fibrotic and Immunologic Lung Diseases

Fibrotic responses (proliferation of connective tissue or scar formation) and immunologic responses are characteristic of a variety of lung diseases, such as asthma. Among the factors that may induce these responses are exposure to substances such as coal dust, silica, and asbestos in the environment; viral and bacterial infections; diseases of the connective tissue such as rheumatoid arthritis, lupus, and scleroderma; radiation damage; and exposure to substances like molds and dust that initiate hypersensitive reactions.

Fields of Study	Areas of Research
Behavioral Sciences Biochemistry Immunology Molecular Biology Morphology Pharmacology Virology	Hypersensitivities: Asthma; defense mechanisms; pharmacologic agents to modify connective tissue reactions Fibrosis: Biosynthesis and degradation of collagen and elastin

5. Respiratory Failure

Respiratory failure occurs when the lungs are unable to maintain proper levels of oxygen and carbon dioxide. Respiratory assistance can be provided by mechanical devices (ventilators or membrane oxygenators) that support the gas transfer functions of the lung.

Fields of Study	Areas of Research
Biochemistry Bioengineering Cell Biology Molecular Biology Physiology	Response to oxygen and carbon dioxide Respiratory assistance

6. Pulmonary Vascular Diseases

Pulmonary vascular diseases include cor pulmonale, pulmonary hypertension, and pulmonary edema. Cor pulmonale is enlargement of the heart caused by an increased workload of the right ventricle resulting from conditions that affect the pulmonary circulation. Pulmonary hypertension is characterized by elevation of pulmonary arterial pressure. Pulmonary edema is a pathologic state in which there is abnormal extravascular storage of fluid in the lung.

Fields of Study	Areas of Research
Behavioral Sciences Biochemistry Bioengineering Epidemiology Morphology Pharmacology Physiology	Pulmonary hypertension and cor pulmonale: Smooth muscle vasculature, noninvasive devices for detection and monitoring Edema: Dynamics of exchange of water, protein, and electrolytes; biochemistry of edema fluid

DIVISION OF
LUNG DISEASES

	Structure and Function of the Lung	Pediatric Pulmonary Disease	Emphysema and Chronic Bronchitis	Fibrotic and Immunologic Lung Diseases	Respiratory Failure	Pulmonary Vascular Diseases
Anatomy, Ultra-structural Anatomy	●					
Behavioral Sciences			●	●		●
Biochemistry	●	●	●	●	●	●
Bioengineering	●	●	●		●	●
Biostatistics		●	●	●	●	●
Cell Biology	●	●			●	
Chemistry						
Electrophysiology						
Endocrinology	●	●				●
Epidemiology		●	●	●	●	●
Genetics		●	●			
Hematology						
Histology	●					
Immunology	●			●	●	
Molecular Biology	●	●	●	●	●	●
Morphology	●		●	●		●
Nutrition						
Pathology		●	●	●	●	●
Pharmacology	●	●		●		●
Physiology	●	●	●	●	●	●
Public Health Management						
Radiography		●	●	●	●	●
Rehabilitation		●	●	●		●
Virology				●		

DIVISION OF BLOOD DISEASES AND RESOURCES

The Division of Blood Diseases and Resources supports programs that encompass fundamental and clinical research and development, research training, health education, and the demonstration of new procedures and techniques in the diagnosis, treatment, and control of blood diseases, as well as the proper management and utilization of the national blood resource. As its major goal, the Division is attempting

- to reduce and ultimately prevent morbidity and mortality from diseases of the blood by determining the cause of these diseases and by improving the diagnosis, treatment, and cure of blood diseases, and
- to facilitate means for providing adequate quantities of safe blood at reasonable costs to all who need it through research into the efficacious use of blood and blood components and the management of blood resources nationally.

RESEARCH PROGRAMS

BLOOD DISEASES BRANCH

1. Thromboembolic Disorders

Thrombosis and embolism contribute to the high morbidity and mortality associated with diseases of the heart and blood vessels. Venous thrombosis can result in pulmonary embolism, and thrombosis may affect the clinical course of many disorders in almost every organ in the body.

Fields of Study	
Anatomy	Hematology
Biochemistry	Histology
Bioengineering	Immunology
Biophysics	Molecular Biology
Biostatistics	Morphology
Cell Biology	Nutrition
Chemistry	Pathology
Endocrinology	Pharmacology
Epidemiology	Physiology
	Radiography

Areas of Research
Thrombosis as related to other diseases
Prevention and therapy: low-dose heparin and drugs that inhibit the adverse effects of platelets and dissolve clots
Diagnosis: instrumentation and chemical and biological assays
Basic mechanisms of thrombosis in animal models
Structure and function of blood vessel walls

2. Platelets and Platelet Disorders

Normal platelets have a function in the coagulation of blood and in the contraction of the clot and therefore participate in thrombosis and hemostasis. Consequently, the Blood Diseases Branch is interested as much in the normal functioning of platelets as in the disorders of platelets.

Fields of Study	
Anatomy	Genetics
Biochemistry	Hematology
Biophysics	Histology
Biostatistics	Immunology
Cell Biology	Molecular Biology
Chemistry	Pathology
Endocrinology	Pharmacology
Epidemiology	Physiology

Areas of Research
Genetic and acquired bases of platelet disorders
Function of platelets in hemostasis
Agents or drugs that prevent platelet aggregation

3. The Hemophilias

The hemophilias are genetically transmitted bleeding disorders that are characterized by the inability of the blood to clot normally. An individual with hemophilia, for example, is subject to spontaneous life-threatening bleeding episodes that can be controlled only by prompt replacement of the missing or inactive clotting factor.

Fields of Study	
Anatomy	Genetics
Behavioral Sciences	Hematology
Biochemistry	Histology
Biophysics	Immunology
Biostatistics	Molecular Biology
Cell Biology	Pathology
Chemistry	Pharmacology
Endocrinology	Physiology
Epidemiology	Rehabilitation

Areas of Research
Genetic and pathologic mechanisms
Antihemophilic factors from human and animal blood and synthetic sources of these factors
Quality and supply of Factors VIII and IX
Coagulation defect with uremia and liver disease
Therapy: side effects, psychosocial aspects, and substitution therapy where there is hepatic failure

4. Cooley's Anemia and Hemoglobin Variants

Cooley's anemia (thalassemia) is an inherited disorder of hemoglobin synthesis that results in anemia and a shortened life expectancy. Adequate treatment for the disease is not available. Although blood transfusions are used for treating anemia, they result in the accumulation of a serious excess of iron in the patient's body.

Fields of Study	
Anatomy	Hematology
Biochemistry	Histology
Biophysics	Immunology
Biostatistics	Molecular Biology
Cell Biology	Pathology
Chemistry	Pharmacology
Genetics	Physiology

Areas of Research
Screening, genetic counseling, and treatment techniques for Cooley's anemia
Chelating agents that prevent or control the iron overload from transfusion therapy
Iron metabolism and hemoglobin synthesis
Genetic aspects, such as mutation frequency and gene loci

5. Erythropoiesis

Erythropoiesis is the process of red blood cell production, which is regulated by the hormone erythropoietin. As primary goals of this program, the Blood Diseases Branch is attempting to stimulate application of the knowledge gained from studies on erythropoiesis to the cure of diseases from stem-cell differentiation, such as aplastic anemia and other disorders of red blood cell production, and to obtain adequate supplies of erythropoietin for use in clinical research.

Fields of Study	
Anatomy	Histology
Biochemistry	Immunology
Biophysics	Molecular Biology
Cell Biology	Morphology
Chemistry	Pathology
Endocrinology	Pharmacology
Genetics	Physiology
Hematology	Rehabilitation

Areas of Research
Red blood cell proliferation
Sources of erythropoietin
Methods for assay of erythropoietin
Use of erythropoietin therapy for refractory anemias
Purification and characterization of erythropoietin

BLOOD RESOURCES AND TRANSPLANTATION BRANCH

1. Management of the National Blood Supply

In supporting research in the management of the national blood supply, the Blood Resources and Transplantation Branch is attempting to assure the accessibility and quality of blood and blood products to everyone in need of them.

Fields of Study
Behavioral Sciences
Biostatistics
Hematology

Fields of Research
Establishment of an all-volunteer blood-donor system
Efficient administration of the national blood supply
Delivery of blood services on a regional basis
Establishment of a national blood-data system

2. Safety of Blood Transfusions

Unless great care is taken in the collection, preparation, and storage of the blood intended for transfusion, diseases or adverse reactions may be transmitted or caused by transfused blood. Currently, the risk of infection or toxic reaction from the transfusion of blood and blood products is unacceptably high.

Fields of Study	
Anatomy	Genetics
Behavioral Sciences	Hematology
Biochemistry	Histology
Bioengineering	Immunology
Biostatistics	Molecular Biology
Cell Biology	Pathology
Chemistry	Pharmacology
Epidemiology	Physiology
	Virology

Areas of Research
Nontoxic, moldable, biologically inert substances for blood-storage containers
Donor-recipient identification of blood for transfusion
Post-transfusion hepatitis
Sensitive, specific tests for detection of hepatitis in blood
Animal models for human hepatitis
Safety and efficacy of hepatitis-B hyper-immune globulin

3. Therapy with Blood Components

Currently, whole blood is used in more than three out of four transfusions, although in most cases only the red blood cells are needed. Reducing the use of whole blood increases the availability of blood components, which are often in short supply.

Fields of Study
Anatomy
Biochemistry
Cell Biology
Chemistry
Hematology
Histology
Immunology
Molecular Biology
Pathology
Pharmacology
Physiology
Virology

Areas of Research
Methods for production of blood components and derivatives
Platelet transfusion
Therapy with platelet, leukocyte, and granulocyte transfusions
Use of blood substitutes for plasma volume expansion and for oxygen delivery
Allergic reactions to intravenous administration of plasma proteins

4. Blood Substitutes

As a major goal, the Blood Resources and Transplantation Branch is supporting the development of a clinically useful blood substitute that will permit conservation of natural blood and blood products.

Fields of Study
Anatomy
Biochemistry
Bioengineering
Biophysics
Cell Biology
Chemistry
Hematology
Histology
Immunology
Molecular Biology
Pathology
Pharmacology
Physiology

Areas of Research
Fluoro-carbon compounds
Stroma-free hemoglobin solutions

5. Transplantation Resources

With regard to transplantation resources, the Blood Resources and Transplantation Branch is supporting the development of tissue and organ banking, as well as the feasibility of using the current blood banking system for tissue and organ networks. The Branch is also supporting the implementation of an effective, nationwide transplantation system.

Fields of Study	
Anatomy	Histology
Biochemistry	Immunology
Biostatistics	Molecular Biology
Cell Biology	Pathology
Genetics	Pharmacology
Hematology	Physiology
	Virology

Areas of Research
Resources that facilitate transplantation therapy
Possible participation of regional blood centers in collecting, processing, and distributing tissues and organs for transplantation

SICKLE CELL DISEASE BRANCH

Sickle Cell Disease

Sickle cell disease is a hereditary disorder that results from the presence of an abnormal hemoglobin (S) in the red blood cells. This hemoglobin, which aggregates within the deoxygenated blood cells and forms a crescentic or "sickle shape," results in a chronic anemia, multiple organ involvement, and painful "crises." Currently, treatment is primarily of the symptoms only.

Fields of Study	
Anatomy	Epidemiology
Behavioral Sciences	Genetics
Biochemistry	Hematology
Bioengineering	Histology
Biophysics	Immunology
Biostatistics	Molecular Biology
Cell Biology	Pathology
Chemistry	Pharmacology
Endocrinology	Physiology
	Rehabilitation

Areas of Research
Hemoglobin synthesis
Structural studies of hemoglobin
Anti-sickling agents
Complications of sickle cell disease
Rheology (blood flow)
Animal models for sickle cell disease
Diagnosis
Red-cell membrane alterations
Education, counseling, and rehabilitation

DIVISION OF BLOOD DISEASES AND RESOURCES	Blood Diseases Branch						Blood Resources and Transplantation Branch				Sickle Cell Disease Branch
	Thromboembolic Disorders	Platelets and Platelet Disorders	Hemophilias	Cooley's Anemia	Erythropoiesis	Management of National Blood Supply	Safety of Blood Transfusions	Therapy with Blood Components	Blood Substitutes	Transplantation Resources	Sickle Cell Disease
Anatomy, Ultra-structural Anatomy	●	●	●	●	●		●	●	●	●	●
Behavioral Sciences			●			●					●
Biochemistry	●	●	●	●	●		●	●	●	●	●
Bioengineering	●							●	●		
Biophysics	●	●	●	●	●				●		●
Biostatistics	●	●	●	●		●	●	●		●	●
Cell Biology	●	●	●	●	●		●	●	●	●	●
Chemistry	●	●	●	●	●		●	●	●		●
Endocrinology	●	●	●		●						●
Epidemiology	●	●	●	●			●				●
Genetics		●	●	●	●		●			●	●
Hematology	●	●	●	●	●		●	●	●	●	●
Histology	●	●	●	●	●		●	●	●	●	●
Immunology	●	●	●	●	●		●	●	●	●	●
Molecular Biology	●	●	●	●	●		●	●	●	●	●
Morphology	●				●						
Nutrition	●										
Pathology	●	●	●	●	●		●	●	●	●	●
Pharmacology	●	●	●	●	●		●	●	●	●	●
Physiology	●	●	●	●	●		●	●	●	●	●
Radiography	●										
Rehabilitation			●	●							●
Virology							●	●		●	